5-5037 - 1158

Department of Energy

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DEC 22 1997

DOE-0225-98

Mr. James A. Saric, Remedial Project Manager
U.S. Environmental Protection Agency
Region V-SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

TRANSMITTAL OF FINAL RESPONSES TO THE U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE REAL-TIME RADIOLOGICAL REPORTS AND PATH FORWARD FOR COMPLETING REAL-TIME RADIOLOGICAL INSTRUMENTATION DOCUMENTATION

The purpose of this letter is to outline the Fernald Environmental Management Project's (FEMP) plans for completing the development of the real-time radiological characterization program. On Thursday, November 13, 1997, a conference call was held between representatives of the FEMP, U.S. Environmental Protection Agency (U.S. EPA), Ohio Environmental Protection Agency (OEPA), and the Ohio Department of Health (ODH) to discuss the revised draft responses to the U.S. EPA comments on the real-time radiological instrumentation reports. During the conference call, a path forward was outlined and discussed for finalizing the real-time reports and completing the necessary steps to obtain regulatory approval to use these real-time radiological systems in the remediation of Area 2, Phase I (A2PI or Southern Waste Units). This letter proposes (1) the process for completing the real-time radiological characterization reports, which are the "Comparability of In-situ Gamma Spectrometry and Laboratory Data" (July, 1997) and the "RTRAK (Radiation Tracking System) Applicability Study" (July, 1997); (2) the documentation and schedule planned for establishing the Quality Assurance (QA) and Quality Control (QC) Program for the high purity germanium (HPGe) and sodium iodide-based systems; and (3) the draft final comment responses addressing the U.S. EPA comments on the draft real-time radiological characterization reports.

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As agreed during the conference call, the enclosed revised draft responses to the U.S. EPA comments on the HPGe and RTRAK reports acknowledge the need for additional real-time instrumentation development to address implementation issues. More specifically, additional information and details are needed concerning the implementation and usability of the real-time instruments under a variety of field conditions, considering varied environmental and field (terrain) conditions. The Department of Energy (DOE) also acknowledges that for the real-time instruments to be used on a routine basis a QA/QC program, including all necessary procedures and training plans, must be developed and instituted for the instruments. Upon U.S. EPA approval of the revised responses and the completion of the remaining addendum, which will address the effect of environmental influences (temperature, humidity, and soil moisture content) on in-situ gamma spectrometry measurements, the FEMP will revise the HPGe and RTRAK Reports. The revised reports will incorporate those actions required by the enclosed response-to-comments as well as from the four (when completed) addenda, which are titled:

1. "Comparability Of Total Uranium Data As Measured By In-Situ Gamma Spectrometry And Four Laboratory Methods" (September, 1997);

2. "RTRAK Applicability Measurements In Locations Of Elevated Radionuclide Concentrations" (September, 1997);

3. "Comparability of In-Situ Gamma Spectrometry And Laboratory Measurements Of Radium-226" (October, 1997); and,

4. "Effect of Environmental Variables Upon In-Situ Gamma Spectrometry Data" (December 1997).

The first three addenda, "Comparability of Total Uranium Data As Measured By In-Situ Gamma Spectrometry And Four Laboratory Methods," "RTRAK Applicability Measurements In Locations of Elevated Radionuclide Concentrations," and "Comparability of In-Situ Gamma Spectrometry and Laboratory Measurements of Radium-226," have been completed and provided to the U.S. EPA and OEPA for review through the Real-Time Working Group Meetings. The addenda numbered (1) and (3) above were addendums to the "Comparability of In-situ Gamma Spectrometry and Laboratory Data." Addendum numbered (2) supplemented the "RTRAK Applicability Study Report." Addendum numbered (4), "Effect of Environmental Variables Upon In-Situ Gamma Spectrometry Data," will soon be completed and submitted to the U.S. EPA and OEPA by December 23, 1997, in order to hopefully be discussed (or at least presented) at the next Real-Time Working Group Meeting, tentatively planned for the second week of January 1998. The final addendum on the effects of environmental variables will supplement both the HPGe and RTRAK reports.

As previously discussed and detailed in some of the enclosed responses, the FEMP will develop a QA/QC Program for the real-time radiological instrumentation. This QA/QC Program will encompass all the necessary tasks to transform the real-time radiological program from the method development mode to the operations mode. The QA/QC Program will be documented as an addendum to the Site-Wide Comprehensive Environmental

Response, Compensation, and Liability Act (CERCLA) Quality Assurance Project Plan (SCQ) and submitted to the U.S. EPA and OEPA for review and approval. Guidance on the usability and limitations aspects of using the real-time radiological instruments will be documented in a separate, stand-alone report, incorporating those aspects of the HPGe Comparability Study, RTRAK Applicability Study, and their associated addenda as needed.

The FEMP will submit by March 31, 1998, the following: (1) the addendum to the SCQ establishing the QA/QC Program; (2) the usability and limitations guidance document for using real-time radiological instrumentation; and, (3) the revised draft final reports, "Comparability of In-situ Gamma Spectrometry and Laboratory Data" and "RTRAK Applicability Study."

If you should have any questions or comments, please contact Robert Janke at (513) 648-3124.

Sincerely,

Johnny Reising

FEMP:R.J. Janke

Johnny W. Reising
Fernald Remedial Action
Project Manager

Enclosure: As Stated

cc w/enc:

N. Hallein, EM-42/CLOV
K. Miller, DOE-EML
G. Jablonowski, USEPA-V, 5HRE-8J
R. Beaumier, TPSS/DERR, OEPA-Columbus
T. Schneider, OEPA-Dayton (total of 3 copies of encs.)
M. Davis, ANL
F. Bell, ATSDR
D. S. Ward, GeoTrans
M. Carpenter, INEEL
R. Vandegrift, ODOH
F. Barker, Tetra Tech
S. Pastor, Tetra Tech
D. Carr, FDF/52-2
J. D. Chiou, FDF/52-5
T. Hagen, FDF/65-2
J. Harmon, FDF/90
C. Sutton, FDF/35
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cc w/o enc:

R. Heck, FDF/2
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EDC, FDF/52-7

RESPONSES TO U. S. EPA TECHNICAL REVIEW COMMENTS ON "COMPARABILITY OF IN-SITU GAMMA SPECTROMETRY AND LABORATORY DATA"

GENERAL COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section : NA Page : NA Line : NA
Original General Comment : 1
Comment:

The accuracy, reliability, and applicability of the measurements made by the high-purity germanium detector (HPGe) are in question because the technology is unproven. To date, the Department of Energy (DOE) has not adequately addressed the limitations of this developmental technology or provided a thorough justification for using it to evaluate waste acceptance criteria (WAC) attainment. However, DOE intends to use the HPGe as an integral part of the soils project. The report should be revised to address the limitations of the technology in terms of its proposed application for the soils project.

Response:

Comment acknowledged. As per discussions which took place during the teleconference on November 13, 1997, the DOE recognizes that additional efforts are needed to ensure the successful field implementation of the HPGe (as well as RTRAK) instrumentation. The focus of these efforts will be in two principal areas: (1) development of a usability and limitations document for the real-time systems and (2) the development and establishment of an overall Quality Assurance and Quality Control (QA/QC) Program for the real-time systems. An outline of the QA/QC program (which is scheduled to be in place by March 31, 1998) consists of the following:

1. QA (RTRAK and HPGe): The FEMP is currently developing a QA Program Plan for in-situ gamma spectrometry in accordance with RM-0012, which details the FEMP's quality assurance program (as directed by the Site-Wide Comprehensive Environmental Response, Compensation, and Liability Act Quality Assurance Project Plan).
2. QC Plan: The FEMP is currently developing a QC Plan or procedure which will address the implementation QC elements that were detailed in Section 5.0 of the HPGe Comparability Study (July, 1997).
3. QC Procedure for Control Charts: The FEMP is currently developing a procedure which will address the generation, use and maintenance of control charts for HPGe in-situ gamma spectrometry.
4. QC Standards Measurement Data Base: The FEMP has established

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a data base to record and track measurement data collected from the Field Control Station and detector calibrations for both RTRAK and HPGe.

5. Preventative Maintenance Procedure: The FEMP is developing a preventative maintenance procedure for HPGe and RTRAK in-situ gamma spectrometry systems.
6. Develop and issue the following procedures: "Operation of the Radiation Scanning System," EQT-34 and "Operation of the Global Positioning System," EQT-GP.
7. Training: Develop, perform, and document the following training for all individuals needed to perform in-situ gamma spectrometry:
   - Training on the use and limitations of the real-time instruments will be performed. A stand-alone document which will provide the guidance on the use and limitations associated with the HPGe and RTRAK/RSS systems is currently under development.
   - Training on QA/QC plans and procedures and training on all operating procedures for in-situ gamma spectrometry.
   - Training on the use and maintenance of gamma spectroscopy software.

Guidance on the use and field limitations associated with the HPGe and RTRAK/RSS systems will be developed and provided to the regulatory agencies as a stand-alone document. Previously, in the transmittal of the comment responses to U.S. EPA and Ohio EPA comments on the Waste Acceptance Criteria (WAC) Attainment Plan, this document was prematurely referred to as the Real-Time Radiological Characterization: Objectives and Limitations report. Although the actual title of this report has not yet been determined, it is recognized that the focus of the report must be to provide guidance on the use, and the associated limitations, of the real-time systems (HPGe, RTRAK and RSS) to accurately and reliably assist the FEMP to meet its soils remediation objectives. The principal drivers to soils remediation requiring the use of real-time radiological instrumentation consist of the need to determine excavation design, help achieve uranium WAC attainment during excavation, comply with hot spot criteria, implement the uranium ALARA goal, and assist in the precertification efforts.

DOE recognizes that the need to obtain EPA approval on this real-time use and limitation document prior to the start of excavation of the Southern Waste Units (currently scheduled for Spring, 1998). Therefore, a draft copy of the document will submitted to the U. S. EPA and Ohio EPA by March 31, 1998.

Implementation issues aside, high-purity germanium detector (HPGe) technology is not new, nor is it unproven. This technology has been routinely used for almost thirty years, both nationally and internationally. Use of this technology has intensified in recent years because of two reasons: the reactor incident at Three Mile Island and the widespread release of radionuclides as a result of the Chernobyl accident.

One recent publication ("Gamma Spectrometry in the Environment," by the International Commission on Radiation Units and Measurements, issued in December 1994) thoroughly discusses HPGe technology and presents an extensive bibliography. Further, the accuracy and reliability of HPGe technology has been amply demonstrated over the past three decades by numerous groups acting independently.

The purpose of the HPGe comparability study was not to "prove" HPGe technology, but rather to demonstrate its applicability relative to contaminants of concern at Fernald. In this regard, the primary focus of the study was analytical in nature: to demonstrate analytical comparability with laboratory data. The primary focus of the study was not how to "best" to use HPGe given its analytical comparability with laboratory data. As noted below and in other responses, such guidelines and interpretations will be issued as portions of other documents.

With regard to applicability of HPGe to evaluate WAC attainment, a recently issued draft report entitled "Comparability of Total Uranium Data as Measured by In-Situ Gamma Spectrometry and Four Laboratory Methods" extends analytical comparability of HPGe data to total uranium concentrations in excess of 1100 pCi/g. A copy of this draft report was given to US EPA and OEPA personnel at the September 10, 1997 Real-Time Technical Workgroup meeting.

Further discussions of applicability and limitations are beyond the scope of the original HPGe comparability study, which is primarily analytical in nature as noted above. A separate document will be written that addresses HPGe user guidelines, system limitations, and measurement strategy issues. This document will be updated periodically to reflect experience gained in HPGe usage.

Action: A separate document will be written that addresses HPGe user guidelines, system limitations, and measurement strategy issues. This document will be updated periodically to reflect experience gained in HPGe usage.

Commenting Organization: U.S. EPA Commentor: Saric
Section : NA Page : NA Line : NA
Original General Comment : 2
Comment:

The text concludes that the HPGe can be used instead of standard sampling and laboratory analysis procedures to determine whether a certification unit (CU) meets soil remediation requirements for total uranium, thorium-232, and cesium-137. However, the results of the Part A Comparability Study, which directly compares the CU decisions from the laboratory and HPGe results, are not convincing. As detailed in the specific comment on Section 6.5, almost all of the laboratory data sets were so far below the final remediation level (FRL) that only gross error by the HPGe would have produced a different decision. For the only two data sets that were not extreme, the HPGe differed once, and that

difference was not protective of human health and the environment. Additional data sets are needed to conclude that the HPGe can be a reliable substitute for standard procedures.

Response:

As discussed in our conference call on November 13, 1997, the demonstration of comparability of the HPGe system with physical samples has been enhanced since the development of the draft HPGe report with additional data at the decision levels. This information (as an addendum to the HPGe report to show comparability of HPGe measurements to physical samples at uranium OnSite Disposal Facility Waste Acceptance Criteria concentrations) was shared and briefly discussed during recent real-time working group meetings. Ultimately, the HPGe Report (as well as the RTRAK report) will be revised to incorporate comment responses and updates obtained through the associated addenda.

Separately, we disagree that the results of the Part A Comparability Study are not convincing. The fact that most of the CUs were well below the FRL for uranium simply reflects the low contamination pattern in Area 1 Phase I. The HPGe methodology in these cases is therefore providing the current decision. In many cases, the measured uranium concentration was about one fourth the FRL, i.e. approximately 20 ppm. If excavation is performed correctly given ALARA goals, uranium levels will likely fall well below the FRL in other areas as well. The case of thorium-232, the data in Appendix C show the HPGe mean concentrations to be generally in the range of 0.9 to 1.1 pCi/g which is only about 25-40% below the FRL (1.5 pCi/g). This is not "far" below. Part B of the Comparability Study was devised to provide a greater range of concentrations and field sites over which comparisons could be made to soil sample data. We do agree that additional data sets closer to or somewhat above FRLs would be instructive in demonstrating comparability for decision making. Future case studies using pre- and post-excavation data sets should provide examples of failures.

In eight of the nine cases that show failure for thorium-232 based lab gamma analysis of samples, the failure resulted not from a measured mean being higher than the FRL, but from the standard deviation of the data set being too large to support a pass decision at the 95% confidence level. The outcome of the test in these cases would likely be reversed if additional samples were collected and the standard error of the mean thus reduced. These eight cases are potentially Type II errors, i.e. declaring a CU requires excavation when in fact it does not. Apart from biases in the data sets associated with the different measurement techniques (which are probably related to calibration), it is clear that the HPGe measurements generally show smaller standard deviations. This is significant in terms of survey design. It reflects the ability of this measurement technique to provide a better average over the survey unit for a given number of measurements. It results from the fact that the HPGe is measuring tons of soil rather than potentially non-representative kilogram (or less) sized quantities. Considering the fact that the dose model is tied to the average concentration of a radionuclide over a large area, obtaining that average in the most efficient and representative manner is advantageous for arriving at the correct

decision rule.

For situations where the actual mean concentration of a radionuclide is close to the FRL, we would expect the pass/fail decision to vary depending upon the standard deviation of the data set. The nature of the statistical test and the parameters chosen will result in declaring a CU to have passed in some cases when in fact it should have failed, i.e., the actual mean concentration in the CU is above the FRL. However, it is important to remember that this error in the decision does not mean the actual concentration is far above the FRL. Indeed, there is a vanishingly small probability that the actual mean could be significantly above the FRL. To suggest that this is not protective of human health and the environment is wrong. The FRL is not a life and death line of demarcation but rather the upper bound of a "gray region" where decision errors have little consequence. The dose model (and associated risk) provide amply conservative FRLs. The error rate is a value that is agreed upon such that it is both realistic and protective.

Action: None.

SPECIFIC COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section : 3.2.2 Page : Tables 3-1 through 3-5 Line : NA
Original Specific Comment : 1
Comment:

These tables contain the reduced data (weighted means and weighted standard deviations) used to determine the results of the Part B Comparability Study. The calculations could not be verified from the full data sets in Appendix A. Those data sets contain 7, 11, or 16 data points per set while the study design (illustrated in Figures 2-3 through 2-5 and Tables 2-2 through 2-4) uses 6, 10, or 15 points per data set. If the extra points are field duplicates, then they should be identified as such and tied to the points they duplicate. In addition, the treatment of the field duplicates in the statistical calculations should be explained. Until the full data sets are reconciled with the study design, no conclusions can be drawn.

Response:

From the discussions which occurred during the conference call on November 13, 1997, the U. S. EPA indicated a desire for comparing non-weighted samples with HPGe measurements. The FEMP indicated that additional studies were in the process of being performed to collect additional HPGe, RTRAK and RSS data which would satisfy the U.S.EPA request. The titles of these three variances are shown below.

1. Variance 50.03.58-3. A variance to Radiation Scanning System Calibration PSP, Rev.0 (Document number 20701-PSP-0001).

2. Variance 50.03.58-4. A variance to Radiation Scanning System Calibration PSP, Rev.0 (Document number 20701-PSP-0001).

3. Variance 50.03.40.03-10. A variance to Comparability Study Part B. PSP, Rev.0 (Document number 20701-PSP-0001).

These variances will be transmitted to the Real-Time Working Group Team Members separately from these comment responses. Any questions or comments could be discussed at our next real-time working group meeting. The paragraphs below were left unchanged.

The difference between the 7, 11, or 16 data points per set and the 6, 10, or 15 data points set forth in Figures 2-3 through 2-5 and Tables 2-2 through 2-4 is due to duplicates. Section 2.2.2.3 notes that one duplicate sample is taken per area, and Section 3.2.2, lines 23 and 24, explain how the duplicates are handled in the statistical calculations.

Calculations to verify the correctness of the weighted means and weighted standard deviations cannot be carried out without knowing which samples are duplicates. Duplicates are not identified in Appendix A, but will be in the next revision of the report. However, correctness of the weighted means and weighted standard deviations has been verified by hand calculations. An example of such a calculation for potassium-40 data for area PBC-01 simulating a 1.0 meter detector height is shown below.

Sample ID	X_i	W_i	W_iX_i	$W_i (X_i - y)^2$
PBC 1-1	11.6	0.1	1.160	0.0810
PBC 1-2	14.0	0.18	2.520	0.4050
PBC 1-3	12.1	0.18	2.178	0.0288
PBC 1-4	15.5	0.18	2.790	1.6200
PBC 1-5	10.5	0.18	1.890	0.7200
PBC 1-6	10.7*	0.18	1.926	0.5832

$\% X_iW_i$ = weighted mean = 12.5

= weighted standard deviation = 0.83

* The value of PBC 1-6 above is really the average of PBC 1-6 and PBC 1-7 given in Appendix A of the HPGe Comparability Study.

These are in agreement with the weighted mean and standard deviation in Table 3-5.

We discovered an error that needs to be corrected, however. A formatting error resulted in incorrect total uranium values being pulled from the Sitewide Environmental Database and tabulated in Appendix A, although all weighted means and weighted standard deviations for total uranium in Section 3.0 of the report were calculated from the correct data. The errors in total uranium values are negligible for areas PBC-02, PBC-04, PBC-05 and PBC-03. They are on the order of 1-5% for the other areas. The correct total uranium values were reported in the first separate addendum report in which comparability was extended to include elevated levels of contamination near WAC values. This report is entitled "Comparability of Total Uranium Data as Measured by In-Situ Gamma Spectrometry and Four Laboratory Methods."

Action: Corrected total uranium values were reported in the study referenced immediately above.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 3.3 Page : 3-7 Line : 19
Original Specific Comment : 2
Comment:

The text discusses criteria for "good comparability" of HPGe results with laboratory results in very general terms. It would be better to make these comparisons more explicit, such as a correlation coefficient of 0.9 or higher (rather than merely "high"), slopes within so many standard error estimates of unity, and intercepts less than 0.1 FRL. Reasonable criteria such as these (chosen in a manner parallel to the criteria in Table 5-1 and related text) will buttress the arguments on page 3-8 and the conclusions in Section 3.4 on the comparability of HPGe and laboratory results.

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Response:

In Section 3.2.2 of the report, we have essentially done what the reviewer has suggested. Using SW846 and CLP SOWs as guidance, we have defined closeness in agreement of data using numerical limits. Numerical limits to describe comparability as "good" or "acceptable" were not set for correlation parameters as the reviewer has noted. This is because it is difficult to relate correlation parameters derived from linear regression analysis to common analytical quality control parameters for accuracy and precision such as those listed in Table 5-1.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 5.2.2 Page : 5-4 Line : 20
Original Specific Comment : 3
Comment:

The text states that bias is acceptable if accuracy criteria are met. It should be noted that it is often possible to correct for bias by judicious use of calibration factors. For instance, if the slope of a test result versus standard result is not unity but does have good linearity (high correlation coefficient), then an appropriate calibration factor can make the test results equal to standard results.

Response:

We agree that apparent bias can be corrected through the appropriate application of empirical correction factors determined as stated in the above comment. One such correction that is under examination is that for disequilibrium for the radon progeny under field conditions for assessing radium-226.

Action:

A "correction algorithm" was developed to account for radon-222 emanation from soils. The use and explanation of this algorithm is contained in a draft report issued on October 7 entitled "Comparability of In-Situ Gamma Spectrometry and Laboratory Measurements of Radium-226." This report was given to US EPA and OEPA personnel at the October 9, 1997 meeting of the Real-Time Technical Workgroup.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 5.3 Page : 5-4 Line : 26
Original Specific Comment : 4
Comment:

The text notes the good correlation between field duplicates. Some more information on the origin of the duplicate results is needed to fully evaluate the solidity of this conclusion.

If one reading was taken at a particular point, followed immediately by the duplicate reading at that point, then the field duplicate results only reflect the short-term drift of the instrument, the inherent randomness of radioactive decay, and similar short-term effects. If the instrument was moved from a point, used elsewhere, and then brought back to the original point for the field duplicate reading, then the precision estimates are more realistic, more comparable to normal variation in exact placement of the instrument, calibration variations, and other such details that may affect the measured results. The field duplicate reading, then the precision estimates are more realistic, more comparable to normal variation in exact placement of the instrument calibration variations, and other such details that may affect the measured results. The field duplicate procedure should be explained in more detail so the robustness of the results can be evaluated.

Response:

The reviewer is correct in noting that the results of the duplicate measurements could be different with a time lag. One manner in which this is being addressed is through repeated measurements at a control location. It should also be noted that there was a very high degree of correlation between the HPGe measurements of FDF and EML. This is significant since there were differences in the detectors and ancillary equipment, spectrum analysis techniques, field personnel, and times of measurement.

The duplicates in the July, 1997 report were sequential readings. Thus, as the reviewer noted, they measure short-term drift of the instrument and inherent randomness of radioactive decay. However, this is analogous to the measurement of duplicates in the laboratory. Typically, duplicates are measured within an analytical batch, not over a period of days. By adopting the laboratory QC criteria for duplicates to use for field measurements, it was felt that the field measurements should be performed close together in time just as laboratory measurements are.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 5.7 Page : 5-12 Line : 21
Original Specific Comment : 5
Comment:

The text states that standard conventions on trend analysis will be used in interpreting the HPGe control charts during future use. Examination of Figures 5-6 and 5-8 showed evidence of trend problems (such as two of three consecutive points between a warning limit and its control limit and eight consecutive points on the same side of the center line) before out-of-control results were found. The procedure to incorporate these techniques in the HPGe analyses should be expected.

Response:

The preliminary control charts do not yet encompass a full range of environmental extremes (e.g. temperature and soil moisture) so that the "final" control parameters can be established. Additionally, correction for the soil moisture effect, that is, converting from a "wet" in-situ measurements to that of "dry" soil is being examined in more detail. The issue of trend interpretation, control limits, and corrective actions will be more specifically spelled out in procedures (that are being expedited).

Action:

A control chart procedure is being expedited.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 6.5 Page : 6-5 Line : 8
Original Specific Comment : 6
Comment:

The text concludes that the HPGe provides "overall equivalency of decisions" on CU certification. However, the laboratory data sets that are included in Table 6-1 are generally so extreme that comparison with HPGe results is virtually meaningless. Only two laboratory data sets give "T" statistics with a probability of 0.01 or greater, total uranium in CU O-20 and radium-226 in CU Q18-40. (Expanding the "t" values of interest to probabilities of 0.001 or greater adds only one more data set, radium-226 in CU P18-12.) HPGe data gave the same decision as the laboratory data for CU O-20, but the opposite decision (acceptable by HPGe, not acceptable by the laboratory) for CU Q18-40. Therefore, if one considers the laboratory data sets with non-obvious results, HPGe agreed one time in two cases and the disagreement was not protective of human health and the environment. On the other hand, if one argues that the HPGe results for radium-226 are unreliable, then the comparability of decision argument rests on only one data set, the uranium in CU O-20. This extremely limited basis for comparison is insufficient for the HPGe results to be considered equivalent to the laboratory results. This conclusion section should be rewritten to discuss this inadequacy and an appropriate path forward,

with additional useful CU comparisons, should be added to Section 7.2.

Response:

See response to General Comment 1. Also, the reviewers' argument for disagreement in decisions based upon HPGe and laboratory measurements for radium-226 for CU Q18-40, while valid, is not germane. We have noted numerous times in the report that HPGe cannot be used to generate reliable, quantitative radium-226 data yet. The study shows that HPGe measurements are consistently biased low to laboratory measurements. Interestingly, for Q18-40, the mean of the HPGe data is 25% lower than the mean of the laboratory data. The regression line for HPGe vs. laboratory radium-226 data (1.0 m simulation) in Appendix D calculates a HPGe value (1.02 pCi/g) that is 32% lower than a laboratory value of 1.5 pCi/g. In this particular instance, the comparability of radium-226 data between HPGe and laboratory measurements for CU Q18-40 is consistent with the comparability of HPGe and laboratory data shown in Section 3 of the HPGe Comparability Study.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 7.1.2 Page : 7-2 Line : 19
Original Specific Comment : 7
Comment:

The text and accompanying Table 7-1 state that the HPGe is capable of verifying that soil remediation goals (both FRL and hot spot criteria) have been met. As discussed in Section 6.5, that has not yet been conclusively demonstrated. Only two CUs had results from standard analyses that led to a reasonable test of the capabilities of the HPGe. The standard results were that one CU passed and one failed, but the HPGe passed both CUs. Unless more such ambiguous CUs are tested and it can be shown that the HPGe produces such errors much less than once in two opportunities, the HPGe must still be considered experimental.

Response:

As stated in our responses to General Comment 1 and Specific Comment 6, future case studies should provide the opportunity to demonstrate pass/fail decisions at radionuclide concentrations closer to the FRL. However, it must be remembered that there will be cases where the pass/fail decision could swing either way depending on the mean and standard deviation of the data set. To wit, a duplicate set of soil samples collected in the same CU could yield opposite results as could a duplicate set of HPGe measurements. Thus, any one soil sample set and one HPGe set could yield opposite results. The important point for protecting human health and the environment is that where the actual mean concentration in the CU is well above the FRL, either method should show failure essentially all of the time. Conversely, to avoid unnecessary excavation, both methods

should pass a CU where the actual concentration is measurably below the FRL.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section : Appendix D Page : D-1 Line : 4
Original Specific Comment : 8
Comment:

The text states that a "commercial statistics program" was used for the calculations in this appendix. The particular program should be identified.

Response:

The commercial statistics program was Statgraphics by Manugistics. This report attempted to follow the general protocol of CLP SOW and SW846 methods in that commercial products were not mentioned by name.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section : Appendix G Page : Table G-1 Line : NA
Original Specific Comment : 9
Comment:

The headers for both pages of this table identify the radionuclides as total uranium and thorium-232. However, the data on the second page seem to apply to potassium-40 and radium-226. The header should be corrected.

Response:

The reviewer is correct. The headers on the second page should indicate that the radionuclides are radium-226 and potassium-40.

Action: This will be corrected in a future revision.

The section below addresses EPA responses to FEMP responses to reviewer comments on a draft copy of the HPGe Comparability Study sent to the U.S. EPA for review. In particular, this section addresses the comments of Reviewer 2.

General Comment 1:

The intent of this comment was to demonstrate that HPGe measurements and analytical sampling may not be comparable for heterogeneous contamination. This comment specifically discussed the disparity between HPGe measurements and analytical

sampling that was conducted from CU O20. However, from review of the response and reevaluating the Fernald Environmental Management Project's (FEMP) Comparability of In-Situ Gamma Spectrometry and Laboratory Data (Comparability Study), dated July 1997, this comment may not have been adequately addressed.

The Comparability Study was intended to demonstrate similar results between analytical sampling and in-situ gamma analysis for both homogenous and heterogeneous radiological contamination. While comparability can be preserved for homogenous conditions, the study fails to show comparability under a heterogeneous environment. If the in-situ HPGe system is to be used for both conditions, comparability for heterogeneous distributions should be demonstrated.

Appendix C provides a statistical evaluation of data used for Part A of the Comparability Study. This Appendix was used to determine if 95% upper confidence limits (UCL) would exceed final remediation levels for both in-situ and analytical results. In ten cases, the 95% UCL exceeded the FRL for analytical sampling (gamma spectrometry), yet, all HPGe and alpha measurements passed. The text discusses that disparity exists between analytical gamma and alpha measurements. Therefore, using the alpha analysis, comparability exists between in-situ and laboratory measurements. However, even if the analytical gamma measurements are ignored, it appears that comparability could only be ascertained for natural background concentrations. Part A of the Comparability Study should demonstrate that certification decisions could be made under conditions when FRLs are met as well as exceeded. Currently, Part A of the study only fulfills one of these objectives.

Response:

The issue of heterogeneity is one that must be considered for survey planning, specifically, how many samples or measurements would be required for a valid decision rule (t-test). If a CU has a highly heterogeneous distribution in the concentration of a particular radionuclide, it will be reflected in the standard deviation of the data set for that CU. A CU should fail because its measured mean concentration is above that of the FRL. If there is a high standard deviation about the mean, more samples or measurements will be required to pass. A high standard deviation is not in itself a condition to fail. That is not part of the decision rule. High outliers may be a condition to investigate further. Moreover, a separate "hot spot" investigation, such as performed through scanning with an instrument system like RTRAK, will provide the assurance that no unusually high elevated areas exist between sample/measurement points. The statistical test for ensuring that the average concentration in the CU is not above the FRL must not be confused with the separate check for elevated areas that may occur between sample or measurement points.

Homogeneity is not a necessary condition to perform a representative in-situ HPGe measurement. Regardless of the actual distribution of the radionuclide, either laterally or with depth in the surface soil, the HPGe will provide a weighted average of the

concentration, with the weighting factor decreasing with radial distance from the point under the detector and also decreasing with depth. Where conditions are highly heterogeneous, this is an advantage over a soil sample. While a soil sample has some probability (generally small) of falling within an elevated area, it is more likely to miss a small elevated area since its dimensions represent a tiny fraction of the area under investigation.

Future field studies carried out to support soil remediation involving measurements before excavation should provide examples of decision rules that indicate failure to meet FRL.

Action: None.

General Comment 2:

This comment discussed a disparity in Part B of the Comparability Study for a hot spot area indicative of heterogeneous contamination. While the response to this comment is understood by the reviewer, and this issue has been raised before, demonstration of comparability between heterogeneous contaminated areas has not been adequately addressed. The majority of data used in the Comparability Study involved regions of low activity with a homogenous distribution in the soil. In fact, a good deal of this data could probably be used to represent naturally occurring radioactivity in soils around the Fernald area.

As stated in Section 1 of the Comparability Study, radiological contamination at Fernald is due to fugitive stack emissions and small releases due to spills and disposal practices. While the fugitive emissions could conceivably result in homogenous distributions, small spills would not. Therefore, if the HPGe system is to be used under a wide range of conditions, demonstration of likewise comparability should also be performed.

Response:

Locations 2, 3, 7 and 10 in Part B of the Comparability Study had the potential for heterogeneity. The nature of contamination at the FEMP is such that relative homogeneity exists over broad areas outside of the production area. Additional comparisons in heterogeneous areas have been performed. However, a condition of heterogeneity is not detrimental to the HPGe measurement technique. In fact, a better case could be made for the HPGe technique as opposed to physical sampling (see response to General Comment 2), particularly with regard to certification measurement.

The issue of heterogeneity is more of a measurement/sampling strategy issue than an analytical issue. Section 3.1.1 of the report attempted to distinguish between analytical influences on comparability and contaminant heterogeneity influences on comparability. The former is the focus of the report. The latter, as stated previously, is more of a sampling issue. All arguments made concerning the degree of representativeness of HPGe data in heterogeneous areas can be equally well applied to laboratory data resulting from

analysis of discrete physical samples from heterogeneous areas.

Given the discussion in the immediately preceding paragraph, a distinction must be drawn between HPGe comparability and HPGe usability. The report demonstrated the analytical comparability of HPGe with laboratory data. The degree of heterogeneity of analyte distribution does not affect analytical comparability. The degree of heterogeneity does affect how the data are interpreted and hence, the usability of HPGe. The reviewer had a legitimate concern about heterogeneity on the scale of, or smaller than, the field of view of the HPGe. Such issues will be examined further, and as noted in the response to General Comment 1, Page 1, the resolution to such issues will be addressed in a stand-alone document. This document will be issued at a later date to address, among other items, how areas of elevated concentration can be delineated using in-situ gamma spectrometry. Such guidelines may involve both HPGe and RTRAK because of their complementary natures, they may involve lower detector heights, they may involve sampling strategies with overlapping grids, or a combination of all of the above.

Action: The action is to issue user guidelines that address how to resolve small scale heterogeneity issues in a future document.

General Comment 3:

This comment was concerned with radiological variability with soil depth and its effects on reliable HPGe results. The response cites Section 4.4 of the Comparability Study in which radiological profiles were conducted as a function of depth. From review of these profiles, it suggests that uranium concentrations drop off exponentially with depth. Therefore, HPGe measurements may be conservative for uranium concentrations. However, the same may not be true for thorium-232 and radium-226 profiles. In these cases, concentrations appear to increase with depth by as much as 20% from the uppermost soil layer. Therefore, assuming homogenous contamination with depth for thorium-232 and radium-226 in these cases may lead to an underestimation of contamination in soil.

The text states that the intended purpose of the study was to show comparability with surficial soils, and that depths greater than 4 inches may not be considered. Although the soil interval between 0 and 4 inches may be considered "surficial" with DOE Fernald, the EPA generally defines surficial soils to be those of either 0 to 6 inches or 0 to 1 foot. Therefore, it is not clear if the Comparability Study is consistent with EPA logic for evaluating surficial soil.

Response:

A 20% variation in the concentration with depth is relatively insignificant for any measurement technique. Given the gross uncertainty in the dose model, these data could actually be used to support the assumption of a uniform concentration profile with depth. Dose models generally assume such a profile. A standard soil sample collected to 15 or

30 cm also provides no information as to the depth profile and, in effect, provides an average over that depth. Future excavation and grading operations will also help to homogenize soils.

As part of the HPGe characterization process, a model of the distribution of contamination must be utilized in order to convert the detector signal in pCi to pCi/g. In this study, the model employed was that of a uniform distribution, both areally and with depth. Section 4.4 was intended only to demonstrate that for the purpose of this study, the model employed appeared valid. More importantly, however, we agree that the model may not be valid in other circumstances. In those situations different "standard" models can be employed; for example, an exponentially decreasing model, a surface layer model, or a depth increasing model. As noted in the response above, the primary intent of this report is to demonstrate analytical comparability, not detailed HPGe usage guidelines. These will be spelled out separately in future documents.

The exact definition of what constitutes "surficial soil" is not relevant to this report. The zero to approximately four inch depth increment is an operational definition of what the HPGe detects on average using both low energy and high energy gamma photons. If only high energy gamma photons are used, the HPGe can "see" significantly deeper than four inches. The important point is that the limitation of HPGe must be kept in mind given the nature of the remedial operations it is supporting.

Action: None.

General Comment 4:

General comment 4 was not intended to be inflammatory. However, as previously stated, the Comparability Study may not adequately address some aspects that may be critical for comparison. Part A of this study was intended to show that certification decisions are comparable for HPGe measurements. Since the majority of data for Part A would be indicative of natural background concentrations, other slightly elevated areas should also be considered. In making certification decisions, comparability should be demonstrated in areas that are below, near equal to, and above the respective FRLs. Part B of the study was to show that HPGe and analytical results are indeed compatible. However, without considering those areas indicative heterogeneous activity, comparison should not be fully ascertained.

Response:

See responses to General Comments 1 and 2, above.

Action: None.

General Comment 6:

The response to general comment 6 states that measurements were made with standards over variable distances from the detector and that linearity may be preserved. A copy of the detector response as a function of distance should be provided for review.

Response:

Table 5-8 (discussed in Section 5.6) contains the data relating detector response to distance of the source from the detector. Figure 5-3 displays these data graphically.

Action: None.

General Comment 7:

The response states that the issue of secular equilibrium with the thorium-232 decay chain has been raised and addressed in a letter to EPA (DOE-0962-97). A copy of this letter should be provided to facilitate this review.

Response:

A copy of the letter referenced above was provided to the reviewer at a technical work session on August 8, 1997.

Action: None.

General Comment 9:

The response to general comment 9 reiterates the original concern. Technetium-99 cannot be detected with the HPGe system, but may exist as a contaminant of concern. Therefore, if the HPGe system is intended to make certification decisions for radiological contaminants, it is not clear how similar decisions would be made for non-gamma emitters that could also be present.

Response:

Non-gamma emitters will be analyzed as necessary by conventional radiochemical analysis of physical samples.

Action: None.

Specific Comment 2:

As previously discussed, the Comparability Study may not adequately address similarity between HPGe measurements and laboratory analysis for areas with

heterogeneous contamination. Furthermore, Part A of the Comparability Study may be viewed as incomplete since comparability of certification decisions was based primarily on natural background conditions.

Response:

See responses to General Comments 1 and 2 above. Additionally, though, we note that if excavation of soils is successful in removing all contamination above FRLs, certification will always involve measuring near background concentrations of contaminant radionuclides.

Action: None.

RESPONSES TO U.S. EPA TECHNICAL REVIEW COMMENTS ON THE RTRAK APPLICABILITY STUDY

GENERAL COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section : NA Page : NA Line : NA
Original General Comment : 1
Comment:

The accuracy, reliability, and applicability of the measurements made by the Radiation Tracking System (RTRAK) are in question because the technology is unproven. To date, the Department of Energy (DOE) has not adequately addressed the limitations of this developmental technology or provided a thorough justification for using it to evaluate Waste Acceptance Criteria (WAC) for attainment. However, DOE intends to use RTRAK measurement results as an integral part of the soils project. The study should be revised to address the limitations of the technology in terms of its proposed application for the soils project.

Response:

Comment acknowledged. As per discussions which took place during the teleconference on November 13, 1997, the DOE recognizes that additional efforts are needed to ensure the successful field implementation of the RTRAK and RSS (jogging stroller-based Sodium Iodide detector) instrumentation. The focus of these efforts will be in two principal areas: (1) development of a usability and limitations document for the real-time systems and (2) the development and establishment of an overall Quality Assurance and Quality Control (QA/QC) Program for the real-time systems. An outline of the QA/QC program (which is scheduled to be in place by March 31, 1998) consists of the following:

1. QA (RTRAK and HPGe): The FEMP is currently developing a QA Program Plan for in-situ gamma spectrometry in accordance with RM-0012, which details the FEMP's quality assurance program (as directed by the Site-Wide Comprehensive Environmental Response, Compensation, and Liability Act Quality Assurance Project Plan).
2. QC Plan: The FEMP is currently developing a QC Plan or procedure which will address the implementation QC elements that were detailed in Section 5.0 of the HPGe Comparability Study (July, 1997).
3. QC Procedure for Control Charts: The FEMP is currently developing a procedure which will address the generation, use and maintenance of control charts for HPGe in-situ gamma spectrometry.
4. QC Standards Measurement Data Base: The FEMP has established a data base to record and track measurement data collected from the Field Control Station and detector calibrations for both RTRAK

and HPGe.

5. Preventative Maintenance Procedure: The FEMP is developing a preventative maintenance procedure for HPGe and RTRAK in-situ gamma spectrometry systems.
6. Develop and issue the following procedures: "Operation of the Radiation Scanning System," EQT-34 and "Operation of the Global Positioning System," EQT-GP.
7. Training: Develop, perform, and document the following training for all individuals needed to perform in-situ gamma spectrometry:
   - Training on the use and limitations of the real-time instruments will be performed. A stand-alone document which will provide the guidance on the use and limitations associated with the HPGe and RTRAK/RSS systems is currently under development.
   - Training on QA/QC plans and procedures and training on all operating procedures for in-situ gamma spectrometry.
   - Training on the use and maintenance of gamma spectroscopy software.

Guidance on the use and field limitations associated with the HPGe and RTRAK/RSS systems will be developed and provided to the regulatory agencies as a stand-alone document. Previously, in the transmittal of the comment responses to U.S. EPA and Ohio EPA comments on the Waste Acceptance Criteria (WAC) Attainment Plan, this document was prematurely referred to as the Real-Time Radiological Characterization: Objectives and Limitations report. Although the actual title of this report has not yet been determined, it is recognized that the focus of the report must be to provide guidance on the use, and the associated limitations, of the real-time systems (HPGe, RTRAK and RSS) to accurately and reliably assist the FEMP to meet its soils remediation objectives. The principal drivers to soils remediation requiring the use of real-time radiological instrumentation consist of the need to determine excavation design, help achieve uranium WAC attainment during excavation, comply with hot spot criteria, implement the uranium ALARA goal, and assist in the precertification efforts.

Implementation issues aside, the RTRAK technology is not new, nor is it unproven. This technology has been in existence for at least a decade and has been extensively used in soil remediation programs, most notably the Uranium Mill Tailings Remedial Action Project (UMTRA). The purpose of the RTRAK Applicability Study was not to "prove" RTRAK technology, but to demonstrate the applicability relative to contaminants of concern at Fernald. With respect to using RTRAK to evaluate WAC attainment, a recently (September 1997) completed draft report entitled "RTRAK Applicability Measurements at Locations of Elevated Radionuclide Concentrations" extends the applicability of RTRAK to areas with total uranium concentrations in excess of WAC levels. Further, this report directly addresses the useability of RTRAK for soils remediation at the FEMP by proposing trigger levels for total uranium, thorium-232 and radium-226. A copy of this draft report was given to U.S. EPA and OEPA at the October 9, 1997 Real-Time Technical Workgroup meeting.

Further discussions of RTRAK applicability and limitations are beyond the scope of the RTRAK Applicability Study, which is primarily analytical in nature. However, a separate document will be written that addresses user guidelines, system limitations, and measurement strategy issues. This document will be updated periodically to reflect experience gained in RTRAK usage. Refer also to the response to General Comment 3.

Action: A separate document will be written that addresses user guidelines, system limitations, and measurement strategy issues. This document will be updated periodically to reflect experience gained in RTRAK usage.

Commenting Organization: U.S. EPA Commentor: Saric
Section: NA Page : NA Line : NA
Original General Comment : 2
Comment:

According to the study, the RTRAK was calibrated against the high-purity germanium device (HPGe), as detailed in Section 3.0. This calibration is then field-verified against other HPGe results, especially in Section 4.3. However, the HPGe is also a developmental technology, so the entire report has limited validity. The foundation of this document must be stabilized with comparisons to accepted laboratory-derived results before non-experimental use of the RTRAK can commence. If the RTRAK results are not directly compared to definitive results, then a propagation of error analysis must be included to fully determine the accuracy of the RTRAK results.

Response:

DOE believes that calibration of the RTRAK using an HPGe instrument is an acceptable and practical approach. The two instruments both provide weighted averages within their fields of view and have similar viewing areas when the HPGe instrument is used with a 31-cm detector height. As the HPGe Comparability Study demonstrates, HPGe measurements correlate well with laboratory data for total uranium and thorium-232. Thus, RTRAK measurements of these parameters are also valid. HPGe measurements of radium-226 do not compare well with laboratory data (are biased low), so RTRAK data will also be biased low for the same reasons that HPGe data are biased low to laboratory data. However, correction factors are being developed that will allow results comparable to laboratory data to be obtained. The reviewer is correct that an error analysis is desirable, and a study will be carried out to assess how errors are propagated by calibrating RTRAK to HPGe instead of to physical samples.

Parenthetically, we note that although part of the intent of the "Comparability of In-Situ Gamma Spectrometry and Laboratory Data" report was to provide the foundation for the acceptance of high purity germanium in-situ spectrometry by U. S. EPA Region 5 and the Ohio EPA, in-situ gamma ray spectrometry is not a developmental technology. Rather, it has been used routinely in support of soil characterization for over 25 years--particularly in Europe and the United States.

Action: An error analysis will be performed to better assess the errors associated with

calibrating RTRAK to HPGe.

Commenting Organization: U.S. EPA Commentor: Saric
Section : NA Page : NA Line : NA
Original General Comment : 3
Comment:

The study generally omits mention of limitations and potential limitations of the RTRAK. The study does discuss the currently limited calibration range, the minimal detectable concentrations (MDC, the main product of this report), and the problem of "shine." However, in addition to traceable accuracy (as discussed in General Comments No. 1 and 2), the study should discuss potential RTRAK limitations under the following conditions: irregular terrain (including slopes and structures as found in the former production area), various weather and soil conditions (especially moisture in the form of flood and rain), and temperature variations.

Response:

The RTRAK applicability study addressed "analytical" limitations and potential "analytical" limitations of RTRAK. It did not address "operational" limitations, such as irregular terrain (slopes and structures, for example). Operational limitations were judged to be better addressed in a stand-alone document or in procedures than in an analytical methodology report. However, with respect to the effects of irregular terrain, a qualitative discussion on RTRAK limitations will be added to a future revision of the RTRAK report.

The effect of environmental conditions on RTRAK data will be the same as the effect of environmental conditions on HPGe data. As noted in the HPGe Comparability Study, a final report on environmental influences in in-situ gamma spectrometry data will be forthcoming as an addendum to the HPGe report. Limitations, guidelines and interpretations contained in that report will apply equally well to the RTRAK.

Action: Limitations, guidelines and interpretations to be delineated in a report on the effects of environmental conditions on the HPGe data will be equally applicable to RTRAK data. These will be included in either a future revision of the RTRAK Report, in RTRAK procedures, or in a stand-alone document as noted in the response to General Comment 1.

SPECIFIC COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section : 3.3 Page : 3-1 Line : General
Original Specific Comment : 1
Comment:

This section discusses the relationship between the activities reported by the RTRAK and those reported by the HPGe for various isotopes. However, it presents

numerical results (correlation coefficients) for only thorium-232 and radium-226. It should also present the correlation coefficients for the two other isotopes discussed, uranium-238 and potassium-40, so the relative accuracy of the RTRAK results for all isotopes of concern can be assessed.

Response: The correlation coefficient (actually, R^2) for the uranium-238 calibration factor is 0.96. As noted on page 3-3, the calibration factor for potassium-40 is not determined from a linear regression equation, but rather from the ratios of HPGe measured concentrations of K-40 to RTRAK net counts. These data are contained in Table 3-2. The standard deviation associated with the mean of these ratios is 0.023 pCi/g/cps, which equates to 10.9% of the mean (0.211 pCi/g/cps). Page 7-3 of the RTRAK report notes that the calibration range will be extended to include data representing areas of higher contamination, so all calibration equations and data contained in this version of the report may well change in the future.

Action: The calibration equations will be revised to reflect higher contamination data when such data are collected.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 4.1.1 Page : Figure 4-2B Line : NA
Original Specific Comment : 2
Comment:

The figure and the associated data tables in Appendix C show very few data points in areas A-37 and A-38. However, Figure 4-2A shows no such data gap from a different series of measurements. This discrepancy should be explained.

Response:

Sections A-35 and A-36 contained very few data points for 1 mph/4 second and 0.5 mph/8 second runs. However, those sections contained a full suite of data points for the 2 mph/2 second run. Investigation of this and similar problems noted in other areas indicates that, when the GPS system does not receive "clean" satellite signals, erroneous location coordinates or erroneous other file position parameters are associated with the measurement. These data must be discarded. This was the case for the two runs noted above. At positions A-35 and A-36, GPS problems caused a majority of the data to be discarded. Sections A-37 and A-38 have erroneous numbers of data points associated with them in Appendix A due to typing errors in the final report. These will be corrected in a future revision to the report. The problem of GPS systems and potentially bad data has been thoroughly discussed at one of the joint U.S. EPA/OEPA/DOE/FDF Real-Time Technical Workgroup sessions.

Action: The FEMP intends to update its GPS system through hardware acquisitions and software modifications. These improvements should substantially eliminate most of the GPS and associated data problems.

Commenting Organization: U.S. EPA Commentor: Saric

Section : 4.1.3.4 Page : 4-9 Line : 27
Original Specific Comment : 3
Comment:

The text states that the 8 second data acquisition second acquisition period has a higher minimum detectable activity than the 2 second acquisition period. This statement should be revised to be consistent with text presented in Section 4.1.3.3.

Response:

Line 28 in Section 4.1.3.4 inadvertently has the "2 second" and "8 second" acquisition times switched.

Action: This will be corrected when the report is revised.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 4.3 Page : 4-16 Line : NA
Original Specific Comment : 4
Comment:

The text discusses the accuracy of the field studies. However, it only compares the RTRAK to the HPGe system. As noted in the general comments, it is essential that the RTRAK be compared to definitive laboratory-measured concentrations.

Response:

See responses to General Comments 1 and 2. Also, RTRAK and HPGe data will be collected in support of ongoing field operations. These area-specific data sets will provide an area-specific basis for assessing the relative agreement between the data sets. This will be a continuous process as data are gathered from different areas. See also the response to General Comment 2 regarding an error analysis study.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 6.2 Page : 6-2 Line : NA
Original Specific Comment : 5
Comment:

The text discusses the use of the RTRAK for determining if soil meets the "as low as reasonably achievable" (ALARA) goal for uranium. It appears from the minimal detectable concentration data in Section 4.2 that such use would not be very practical, even if the calibration to the HPGe gives results equivalent to laboratory data. This limitation should be explicit.

Response:

The comment is correct if individual measurements were to be used for monitoring ALARA. As Table 4-8 indicates, the MDC for uranium-238 is 46.8 pCi/g (141 ppm) at 0.5 mph and an 8 second acquisition time. This is not lower than the ALARA limit of 50 ppm. However, as pointed out in Table 4-8. Section 5.2, Table 5-1, and Section 6.2, the MDC and precision can be substantially lowered (MDC) or improved (precision) by aggregating measurements. Thus, the report recommends using a 40 ft. averaging radius to aggregate measurements to support ALARA implementation.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 6.4 Page : 6-4 Line : 26
Original Specific Comment : 6
Comment:

The text states that the "hot spot" criterion is three times the final remediation level (FRL). However, the Area 1 Phase I Certification Report dated June, 1997, uses twice the FRL as the criterion for a hot spot. This text, and the related material in this section and in Section 6.3, including Tables 6-1 and 6-3 and Figure 6-7, must be revised to reflect the hot spot criterion actually being used.

Response:

This issue is currently being discussed and be resolved through the revised of the Site-Wide Excavation Plan (SEP). In summary, the FEMP is proposing that future "hot spot" criteria be developed that are at both two-times and three-times the respective primary radionuclide's FRL. If found to be acceptable, the RTRAK Applicability Study, when revised, would reflect these proposed criteria.

Action: None.
Commenting Organization: U.S. EPA Commentor: Saric
Section : 7.1.1 Page : 7-1 Line : 24
Original Specific Comment : 7
Comment:

The text discusses the problem of "shine," scattered radiation from nearby major sources. This discussion would be enhanced by an actual example. The Waste Acceptance Criterion (WAC) Attainment Report for Area 1 Phase I, Western Portion, dated June 1997, includes mention of such shine from a nearby thorium storage facility. This example, or a similar one, should be included in the discussion.

Response:

Section 7.3 (Additional RTRAK Method Development) noted additional work was needed to address "shine." Specifically, Section 7.3 suggested the following method development study:

- Investigate methods for mitigating interferences from elevated radiation fields (shine) and develop quality control indicators that "shine" (may be present) and that data and spectra need to be evaluated and interpreted accordingly.

Action: Results of this additional study will be added to a future revision of the RTRAK report and/or as interpretive guidelines in an in-situ gamma spectrometry operating procedure.

Commenting Organization: U.S. EPA Commentor: Saric
Section : 7.3 Page : 7-3 Line : 2
Original Specific Comment : 8
Comment:

The text of this bullet notes that the RTRAK was calibrated against the HPGe. It should

also note the this calibration is not yet anchored by real laboratory results.

Response:

Refer to response to General Comment 2 and Specific Comment 4 for a discussion of this comment.

Action: No specific action; however, the calibration equations may be revised in the future.

Commenting Organization: U.S. EPA Commentor: Saric
Section : Appendix A, Section A.5 Page : A-6 Line : 28
Original Specific Comment : 9
Comment:

The text states that peaks are wider at higher energy because resolution increases with energy. Actually, resolution is an inverse function of peak width, so a wide peak will have lower resolution. The text should be corrected.

Response:

The comment is correct.

Action: The text will be corrected in a future revision of the report to state that the resolution decreases with increasing energy.

Commenting Organization: U.S. EPA Commentor: Saric
Section : Appendix B Page : B-1 Line : 2
Original Specific Comment : 10
Comment:

The text states that the hot spot criterion is three times the FRL. As noted above, in the comment on Section 6.4, this must be corrected to twice the FRL throughout this appendix.

Response:

The FEMP is proposing in the draft Sitewide Excavation Plan (SEP) to use a hot spot criterion of three times the FRL. This criterion was used in the RTRAK Applicability Study for consistency with the draft SEP. Refer also to the response to Specific Comment 6 for additional discussion of this issue.

Action: None.